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(58) Field of search
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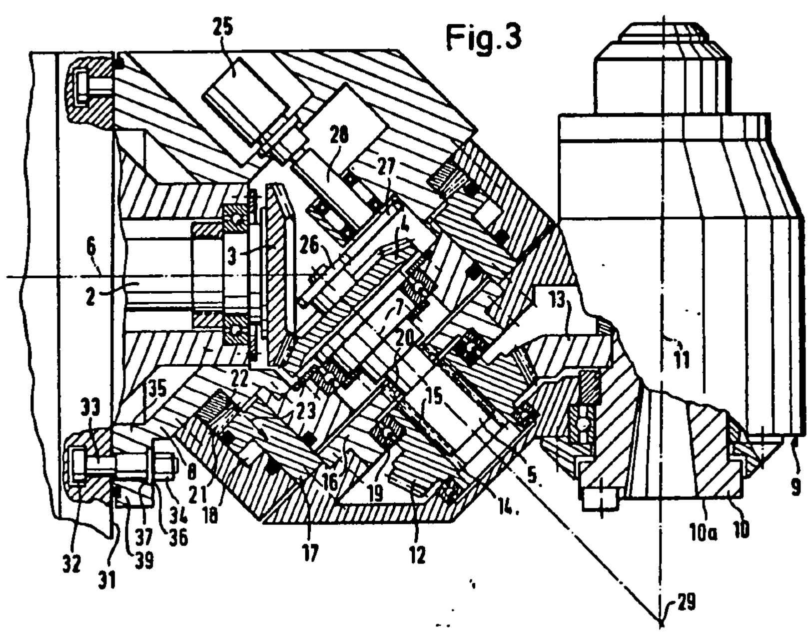
Selected US specifications from IPC sub-classes B23B B23C B23Q

(54) Machining unit with tilting head

(57) The head (9) is able to tilt from a vertical into a horizontal working position and back again. For tilting, the head (9) is driven by a drive shaft (2), by which a work spindle (10) located in the head (9) can also be driven. Since the tilting drive (5, 4, 3, 16) of the tilting head is derived from the drive shaft (2), no additional indexing mechanism for the tilting head (9) is necessary. A gear (16) of the tilting drive is moved into engagement with a drive shaft (5) by a fluid actuated piston (17) which also disengages the head from an intermediate support (8). The support (8) may also be rotated about the shaft (2) by crossing clamping bolts (33).

Fig.3



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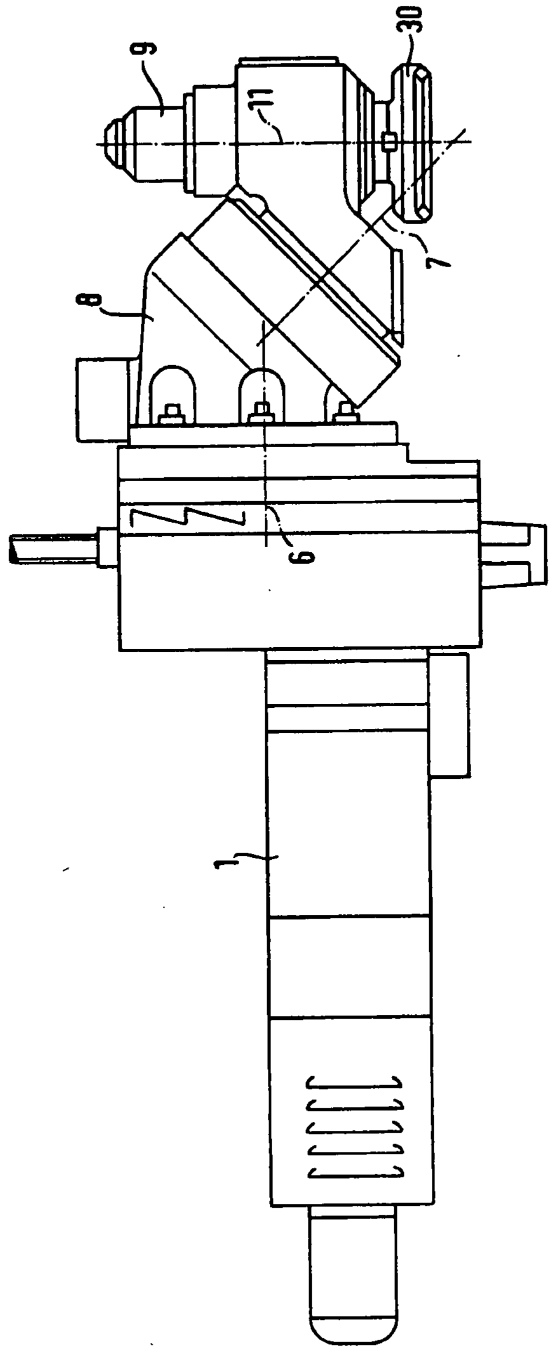

Fig.1

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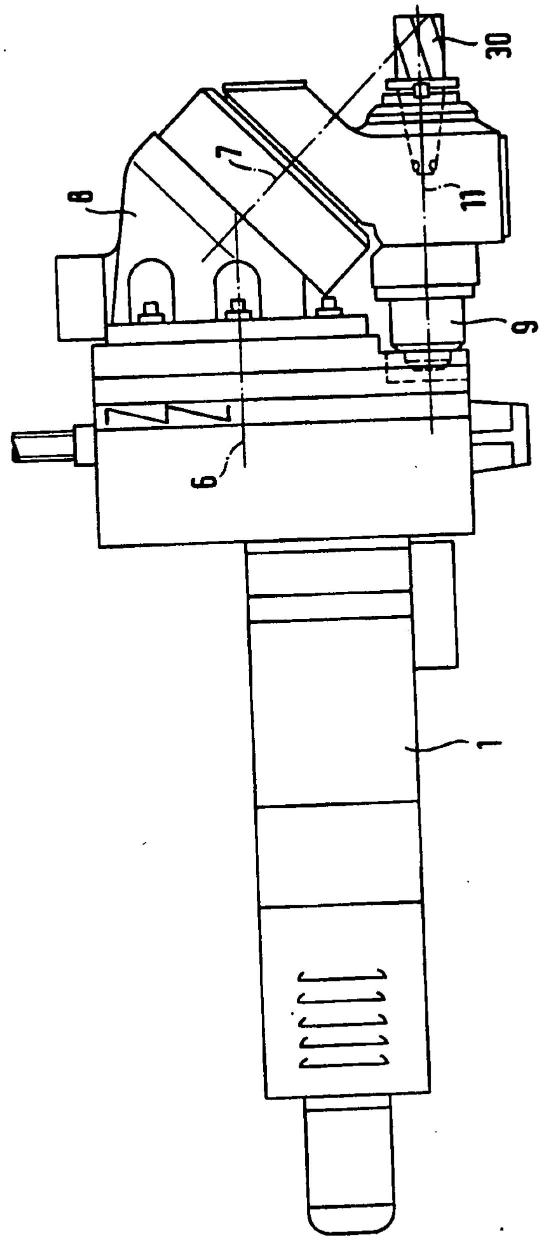

Fig. 2

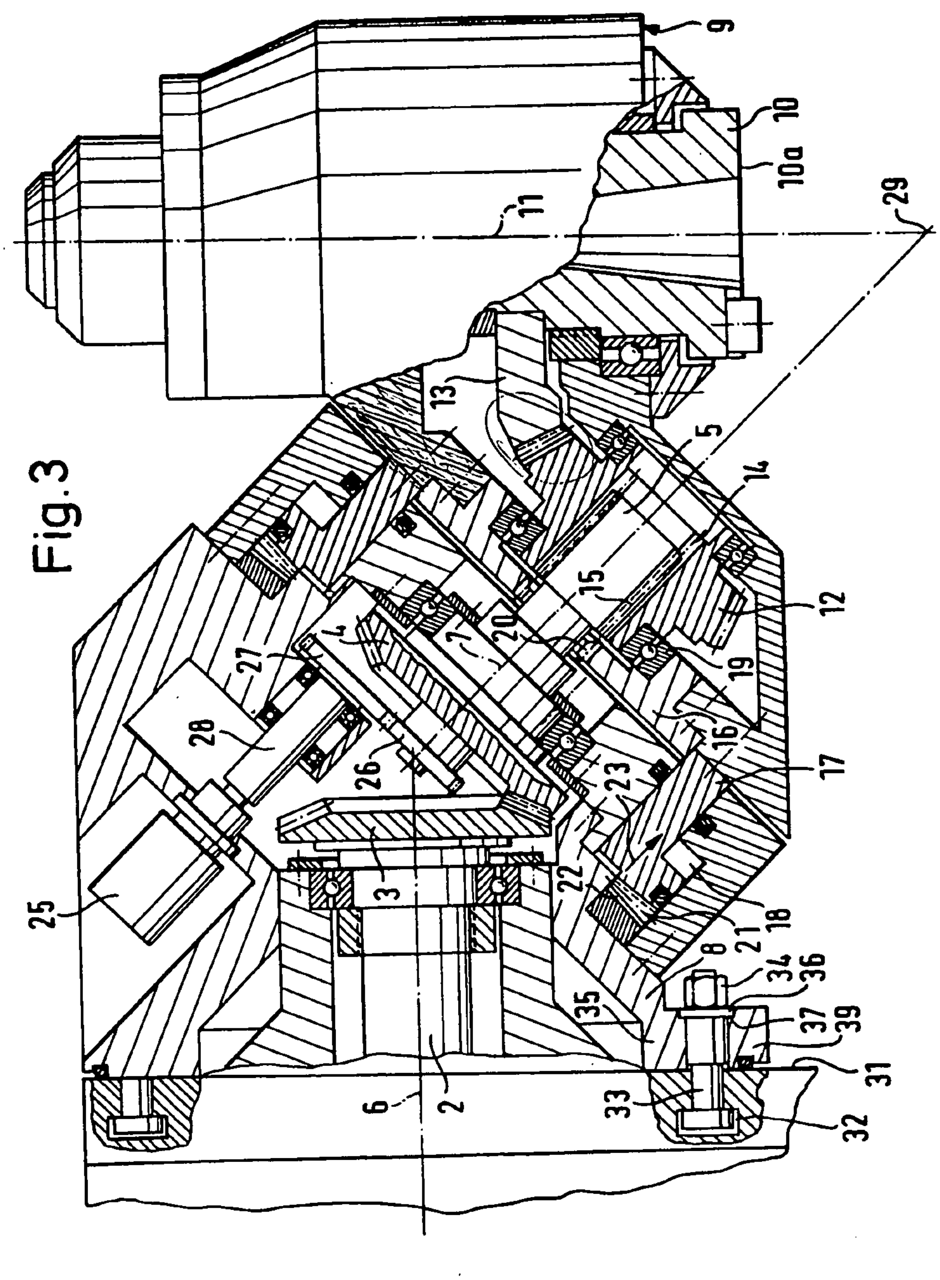
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Fig.3

SPECIFICATION

Machining unit

The invention relates to a machining unit, and in particular to a milling end drilling unit comprising a head tiltable about an axis inclined relative to a drive shaft therefor to which it is connected by first or second gearing.

In a known machining unit of this type, for example as shown in German OS 24 58 399, the tilting head is able to tilt about the centre line of the intermediate axis from the vertical into the horizontal working position and back again. Since the intermediate axis lies at an angle of 45° with respect to the drive shaft of the drive motor, the two working positions of the tilting head can be achieved by tilting about the centre line of the intermediate axis. The work spindle of the tilting head is driven in a rotary manner by the drive shaft by way of the two sets of gearing. For tilting the tilting head into the two working positions it is known from the Journal "Werkstoff und Betrieb" (Materials and Operation), volume 6, 1983, special section page 38 and page 40, to provide a separate driving device. As a result of this separate driving device, the machining unit has a complicated construction, since an additional indexing mechanism is necessary.

It is the object of the invention to construct a machining unit of this type so that the tilting movement of the tilting head requires no complicated driving device.

The invention provides a machining unit comprising a tilting head, which is able to tilt about a tilting axis located at an angle with respect to a drive shaft of a drive motor, between a vertical position and a horizontal working position, a work spindle, which has a driving connection by way of first and second gearing to said drive shaft, and intermediate drive means selectively driven by the drive shaft for the purpose of tilting the tilting head.

In this machining unit, no separate driving device is provided for tilting the tilting head. The drive shaft of the drive motor serves not solely for driving the work spindle, but also for tilting the tilting head into the two working positions. Since the tilting drive of the tilting head is derived from the drive shaft, no additional indexing mechanism for the tilting head is required, so that this machining unit may have a simple and compact construction. This machining unit can consequently be used pre-eminently in machining centres.

The invention is described in detail hereafter with reference to one embodiment of machining unit according to the invention illustrated in the accompanying drawings, in which:

Figure 1 is a side view in which the tilting head is located in a vertical position,

Figure 2 is a view similar to that of Figure 1, in which the tilting head is located in the horizontal position,

Figure 3 is a partial cross section.

In the embodiment, the machining unit is a milling unit and has a drive motor 1 (Figures 1 and 2), by which s drive shaft 2 is driven. Its free end supports a bevel gear 3, which meshes with a bevel gear 4 of an intermediate shaft 5. In the position illustrated in Figure 3, it is located at an obtuse angle with respect to the drive shaft 2. In the embodiment, the two axes 6 and 7 of the drive shaft 2 and of the intermediate shaft 5 enclose an angle of 45° with respect to each other. The intermediate shaft 5 is located in an intermediate support 8, on which a milling head 9 with a work spindle 10 is mounted as the tilting head. The intermediate support 8 is able to rotate about the axis 6 of the drive shaft 2. Since the axis 7 of the intermediate shaft 5 lies at an angle of 45° with respect to the axis 6, on tilting about the axis 7 of the intermediate shaft, the milling head 9 can be shifted from the vertical position illustrated in Figure 1, in which the axis 11 of the work spindle 10 lies vertically, into the horizontal position illustrated in Figure 2, in which the axis 11 of the work spindle extends horizontally.

At the end remote from the bevel gear 4, the intermediate shaft 5 is surrounded by a further bevel gear 12, which is mounted in a fixed manner in the milling head 9 and is in engagement with a bevel gear 13 on the work spindle 10. The intermediate shaft 5 with its bevel gear 4 is mounted to rotate in the intermediate support 8. The work spindle 10 is driven in a rotary manner by the drive motor 1 by way of the drive shaft 2, the bevel gearing 3, 4, the intermediate shaft 5 and the bevel gearing 12, 13.

The bevel gear 12 engages with internal toothing 14 in external toothing 15 of the intermediate shaft 5. The intermediate shaft 5 is surrounded by an axially displaceable gear ring 16, which is fixed to the milling head 9, for example is screwed to the latter. The intermediate support 8 comprises a cylindrical space 18 with an annular piston 17. On its side remote from the gear ring 16, it is provided with radial toothing 21, which is preferably Hirth-type toothing. It engages in corresponding radial toothing 22, preferably Hirth-type toothing, of the intermediate support 8, when the annular piston 17 is located in the position illustrated in Figure 3. The bevel gear 12 is supported by a bearing 19 on the gear ring 16. It is provided with internal toothing 20, which during the drive of the work spindle 10, is out of engagement with the external toothing 15 of the intermediate shaft 5.

During operation with the milling head 9, the work spindle 10 is driven in a rotary manner in the manner described by the drive motor 1 by way of the drive shaft 2, the bevel gearing 3, 4 and 12, 13 as well as by way of the intermediate shaft 5. The annular piston 17

assumes its end position illustrated in Figure 3, in which the two sets of Hirth-type toothing 21, 22 are in engagement with each other. In this way, the milling head 9, which is fixed to the gear ring 16, is locked with respect to the intermediate support 8. The intermediate shaft 5 is able to rotate by its two bevel gears 4, 12 with respect to the intermediate support 8 and the gear ring 16.

If the milling head 9 is to be shifted from the vertical position into the horizontal position or vice versa, first of all the drive motor 1 is stopped, so that the work spindle 10 stops. Then, the annular piston 17 is acted upon in the direction of arrow 23 (Figure 3). It is displaced in the cylindrical space 18 and entrains the milling head 9, due to which the bevel gear 12 mounted in the latter in a fixed manner is also entrained. The annular piston 17 is moved until the two sets of Hirth-type toothing 21 and 22 are out of engagement. At the same time, the gear ring 16 on the intermediate shaft 5 is moved so far until its internal toothing 20 comes into engagement with the external toothing 15 of the intermediate shaft 5.

Then the drive motor 1 is again switched on. By way of the drive shaft 2, the bevel gearing 3, 4, the intermediate shaft 5 and the gear ring 16, a driving connection to the milling head 9 is now provided, so that it can be tilted by means of the drive shaft 2 into the corresponding horizontal or vertical position. As soon as this end position is reached, the drive motor 1 is again stopped and the annular piston 17 is acted upon in the opposite direction.

The sets of Hirth-type toothing 21, 22 again come into engagement, whereas the gear ring 16 with its internal toothing 20 comes out of engagement with the external toothing 15 of the intermediate shaft 5. The bevel gear 12 is in this case moved back into its initial position illustrated in Figure 3.

The intermediate support 8 is stationary during the aforedescribed tilting movement of the milling head 9. The sets of Hirth-type toothing 21, 22 ensure an exact location of the two end positions of the milling head 9. With the latter, the milling head 9 can be arrested in a trouble free manner inthe working position and unlocked in a simple manner for the purpose of shifting.

For the shifting of the milling head 9, as a result of the aforedescribed construction, only the drive motor 1 is provided, by which the work spindle 10 is also driven.

The milling unit is therefore characterised by a very simple construction, since no separate driving device for shifting the milling head 9 is required. The device required for locking and unlocking the milling head 9 is provided in a space-saving manner on the intermediate support 8, so that thp external dimensions of the milling unit are not increased.

In order that the exact end position of the milling head 9 can be determined, the milling unit is equipped with an incremental rotation transmitter 25 (Figure 3). For aligning the working spindle 10, it appropriately has a transmission ratio of 1:1 with respect to the work spindle. By means of the rotation transmitter 25, the working spindle 10 can be aligned in both working positions of the milling head 9, so that an automatic exchange of tools can be carried out without difficulties. The exchange of tools is thus possible in each tilted position of the milling head. Furthermore, work with aligned tools 30 in both positions of the milling head 9 are possible. The drive motor 1, which is designed as a regulated d.c. motor, may shift the milling head 9 at low speed into the horizontal or vertical position. The rotation transmitter 25 has a shaft 28 with a gear wheel 27, which engages in a gear wheel 26 of the intermediate shaft 5. When the milling head 9 tilts, the gearing 26, 27 is rotated by way of the intermediate shaft 5, so that on reaching the respective tilting angle, the rotation transmitter 25 can send a signal to the drive motor 1 and stop the latter. At the same time, a signal can be sent to a piston control arrangement, which controls the supply of pressure medium to the piston 17, which is preferably operated hydraulically. By means of the rotation transmitter 25, the work spindle 10 can also be aligned in the horizontal and vertical working position of the milling head 9, since by way of the gearing 26, 27, any rotary movement of the intermediate shaft 5 and thus of the drive shaft 2 and work spindle 10 is imparted to the rotation transmitter.

In the vertical position (Figure 1), the milling head 9 can be tilted by way of addition about the axis 6 of the drive shaft 2. The milling head 9 can be tilted for example from the vertical position in both directions up to 90°. In this case, the intermediate support 8 is rotated about the axis 6 relative to an end face 31 of the milling unit lying at right angles to the axis 6 of the drive shaft 2 and is positioned in the respective angular position by means of frictional resistance. In the end face 31, screws 33 are located in an annular groove 32 of T-shaped cross section, on which nuts 34 are screwed. They each have a collar 36, which comes to bear against a shoulder surface 37 of a flange 35 of the intermediate support 8. When the nuts 34 are tightened, by way of the collar 37, frictional resistance between the intermediate support 8 and the opposing component of the milling unit is produced. If the milling head 9 is to be swung in the vertical position about the axis 6 of the drive shaft 2, first of all the nuts 34 are loosened. The intermediate support 8 is then rotated manually or by motor about the axis 6 into the desired angular position. Since the screws 33 are located in the T-shaped

annular groove 32, during the rotation of the intermediate support 8, they are displaced in the annular groove 32 lying coaxially with respect to the drive shaft 2.

Then the nuts 34 are again tightened and thus the milling head 9 is positioned by frictional resistance in the new angular position. Located in the flange 35 of the intermediate support 8 is an annular seal 39, which bears against the end face 31 and surrounds the screws 33. Due to this the intermediate space between the end face 31 and the flange 35 of the intermediate support 8 is reliably sealed.

CLAIMS

1. A machining unit, comprising a tilting head, which is able to tilt about a tilting axis located at an angle with respect to a drive shaft of a drive motor, between a vertical position and a horizontal working position, a work spindle, which has a driving connection by way of first and second gearing to said drive shaft, and intermediate drive means selectively driven by the drive shaft for the purpose of tilting the tilting head.

2. A machining unit according to Claim 1, wherein said intermediate drive means which can be brought into operation for tilting the tilting head comprises gearing located in a driving connection between the drive shaft and the tilting head.

3. A machining unit according to Claim 2, wherein the intermediate gearing comprises a gear wheel, which can be brought into engagement by internal toothing thereof with external toothing of an intermediate shaft, whose axis is said tilting axis.

4. A machining unit according to Claim 3, wherein the gear wheel surrounds said intermediate shaft and csn be connected to said intermediate shaft by relative axial displacement.

5. A machining unit according to Claim 3 or 4, wherein the gear wheel is fixed to the tilting head.

6. A machining unit according to any one of Claims 3 to 5, wherein the tilting head is positionally secured by way of an annular piston during working with the work spindle on the machining unit.

7. A machining unit according to Claim 6, wherein in the working position of the tilting head, the annular piston engages with radial teeth thereof in radial teeth of an intermediate support.

8. A machining unit according to Claim 7, wherein the radial teeth are Hirth-type teeth.

9. A machining unit according to Claim 7 or Claim 8, wherein when a pressure medium is supplied to the annular piston, the gear wheel of the intermediate gearing can be brought with its internal toothing into engagement with the external toothing of the intermediate shaft, whilst at the same time the radial teeth of the annular piston and of the intermediate support are brought out of engagement.

10. A machining unit according to any one of Claims 3 to 9, wherein, for the accurate determination of the tilting travel of the tilting head, a rotation transmitter is incorporated in said intermediate driving means.

11. A machining unit according to Claim 10, wherein the rotation transmitter has a driving connection to said intermediate shaft by way of gearing.

12. A machining unit according to Claim 11, wherein the transmission ratio of the rotation transmitter with respect to the work spindle by way of the gearing is 1:1.

13. A machining unit according to any one of claims 3 to 12, wherein the axis of said intermediate shaft is at substantially 45° to the axis of said drive shaft.

14. A machining unit substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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DERWENT-WEEK: 198622

TITLE: Machining unit with tilting head - has tilting axis located at angle w.r.t. drive shaft of motor and work spindle drivingly connected to drive shaft

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PATENT-ASSIGNEE: GEBR HELLER MASCHFAB GMBH[HELG]

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GB 2167327 B	December 2, 1987	N/A	000	N/A
SE 460525 B	October 23, 1989	N/A	000	N/A
SE 8504145 A	March 19, 1986	N/A	000	N/A

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INT-CL (IPC): B23B019/00, B23B047/00 , B23C001/12 , B23Q005/22 , B23Q039/00

ABSTRACTED-PUB-NO: GB 2167327A

BASIC-ABSTRACT:

The head (9) is able to tilt from a vertical into a horizontal working position and back again. For tilting, the head is driven by a drive shaft (2), by which a work spindle (10) located in the head can also be driven. No additional indexing mechanism for the tilting head is necessary.

A gear (16) of the tilting drive is moved into engagement with a drive shaft (5) by a fluid actuated piston (17) which also disengages the head from an intermediate support (8). The support may alsobe rotated about the shaft by crossing clamping bolts (33).

USE - Partic. as a milling and drilling unit.

ABSTRACTED-PUB-NO: GB 2167327B

EQUIVALENT-ABSTRACTS:

The head (9) is able to tilt from a vertical into a horizontal working position and back again. For tilting, the head is driven by a drive shaft (2), by which a work spindle (10) located in the head can also be driven. No additional indexing mechanism for the tilting head is necessary.

A gear (16) of the tilting drive is moved into engagement with a drive shaft (5) by a fluid actuated piston (17) which also disengages the head from an intermediate support (8). The support may alsobe rotated about the shaft by crossing clamping bolts (33).

USE - Partic. as a milling and drilling unit.

CHOSEN-DRAWING: Dwg.3/3 Dwg.3/3

TITLE-TERMS: MACHINING UNIT TILT HEAD TILT AXIS LOCATE ANGLE DRIVE SHAFT MOTOR
WORK SPINDLE DRIVE CONNECT DRIVE SHAFT

DERWENT-CLASS: P54 P56

SECONDARY-ACC-NO:
Non-CPI Secondary Accession Numbers: N1986-102980